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International SportMed Journal

Obesity prevalence for athletes participating in soccer at the World Masters Games

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Abstract

Background: Thousands of masters athletes participate quadrennially in the World Masters Games (WMG). However, this unique cohort remains under-investigated. With a need for multifaceted solutions to the global obesity epidemic, investigating special populations such as those competing in sport at older ages may further understanding of the nexus between aging, physical activity and obesity. **Research question:** To investigate body mass index (BMI) within the WMG competitors in context with national populations and health guidelines. To test the hypotheses prevalence of obesity in the WMG cohort would be less than comparative national populations and males would demonstrate a higher level of obesity than females. **Type of study:** Cross-sectional comparative study. **Methods:** 592 (44.3% male, 55.7% female) WMG soccer players aged 29-66yrs (mean 47.6, SD \pm 6.9) were investigated via an online survey and compared to national populations, primarily a representative sample (n=9,501) of the Australian population (aged 30-65yrs). **Results:** Analysis demonstrated a significantly ($p < 0.001$) reduced classification of obesity compared to Australian and other national populations. The investigation revealed, amongst other findings, that male soccer players had higher BMI than females ($p < 0.001$). **Conclusions:** This study indicated that one key index of health, namely obesity, was on average far lower in WMG soccer players compared to a representative sample of population controls. This finding may indicate a lower risk for many



diseases, such as type 2 diabetes or heart diseases, in masters soccer players. **Keywords:**
quetelet index, sports, exercise

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Introduction

In 2009, the Sydney World Masters Games (WMG) attracted 28,089 competitors across 28 sports¹. Recognised by the International Olympic Committee, it is the largest international sporting competition in terms of participant numbers. This cohort of middle to older-aged adults remains under investigated with regards to various measures of health.

Regular exercise across the lifespan is beneficial for improved health and decreased prevalence of various diseases and disorders²⁻⁴. Masters athletes may display age-related increase to the range of pathologies present in this population, as well as age-related physiological changes^{3,5,6}. These changes may attribute to reduced physical activity, reduced metabolism and thus altered body mass index (BMI)⁷.

Excess body mass is associated with increased risk of conditions such as type 2 diabetes, cardiovascular disease, hypertension and dyslipidemia, as well as certain cancers⁸. In 2008, globally 1.5 billion adults over the age of 20 were overweight, with 200 million of these men and 300 million of these women being classified as obese⁹.

The problem is particularly relevant for the Australian population, as the proportion of Australians classified as overweight or obese has been progressively increasing¹⁰. In 2007-2008, a greater percentage of males were classified by the Australian Bureau of Statistics as more obese than for females. BMI classification was higher for males than for females, with 63% of Australian males classified as overweight or obese, whilst this number was 48% for females¹⁰. In Australia, high BMI has been shown to be responsible for 7.5% (males 53%, females 47%) of total disease and injury and only second to

smoking as a cause of preventable death¹¹. The deleterious influence of a high BMI on the health of males was found to be greater than for females in Australia¹¹. In this study it was also shown that classification as overweight (as well as obese) enhanced the risk of adverse conditions. Total deaths attributable to excess weight in Australia is rising, with an estimated figure of 9500 in 2003¹¹. With the inclusion of the economic costs of lost productivity, it was estimated that obesity resulted in a financial cost of \$21 billion to Australian society in 2005¹². The effective management of the Australian obesity epidemic therefore is both a health and economic priority. This is a consideration which must apply similarly to many developed and developing countries alike. As per most other national populations, there is also a tendency for increased BMI with increasing age¹⁰.

On a population level, BMI is a valuable tool for assessing body mass. On an individual level and for certain specific populations, inaccuracies arise with correlating BMI with anthropometric body composition and thus the health implications of relatively high fat mass. Due to high muscle mass, there are some limitations of BMI as an index for athletic populations¹³. It should also be noted that BMI calculated from self-reported data may provide an under-estimate of true BMI¹⁴.

With many factors behind the obesity epidemic, it is necessary to investigate various populations in order to develop a multi-faceted understanding of and possible solutions¹⁵ to the obesity epidemic. It may be possible to glean additional insight into the scope of and nature of the solutions for the BMI epidemic by consideration of special populations, such as those that exercise competitively in later life.

Despite the propensity for increased muscle



mass from competitive sport, it was hypothesised that due to physical activity, the BMI of the survey participants would be significantly lower than a comparative general population and there would be a lower prevalence of obesity ($\text{BMI} \geq 30 \text{ kg/m}^2$)¹⁶. It was hypothesised that the BMI for male soccer players in the Sydney WMG sub-sample would be higher than for their female counterparts, in line with trends in the Australian adult population.

The purpose of this study was an analysis of soccer participants' BMI at the 2009 Sydney WMG, in conjunction with comparative general populations in order to gain a greater understanding of the nexus between indices of health, physical activity and ageing.

Methods

Approval for this study was granted by the Research Ethics Committee of the Australian Catholic University in accordance with the ethical standards of the Helsinki Declaration of 1975 (revised in 2008).

An online survey created using Limesurveytm was utilised to investigate participants' demographics. Electronic invitations were sent to masters games athletes who provided a valid email address upon registration. Data collection included demographic data for participants, such as height (nearest cm), body mass (nearest kg) and age (total years). BMI was derived from this self-reported data and categorised using conventional classification values⁸.

Data for comparative purposes from the Australian National Health Survey 2007-2008 was obtained via the ABS/Universities Australia Agreement. This data contained unit record files for the Australian population with identifiers removed and some ratio data (such as age) collapsed into categorical format. Comparison was also made with published sample populations containing empirical, national and sub-national BMI data for a wide variety of countries¹⁸⁻²². Due to the large sample sizes involved these figures were of value for comparative purposes.

Analysis of the data was completed using PASW (Statistics 18.0.0). Comparisons of classification count data was conducted using Pearson's chi-square statistic. Significant differences between groups within the WMG sample were analysed using independent t-tests or an appropriate non-parametric alternative. Normality was assessed by investigating Q-Q plots, as well as the Kolmogorov-Smirnov (KS) test with Lilliefors significance correction. Heteroscedasticity was assessed using Levene's test.

Results

Of the 592 respondents of this WMG soccer player sub-sample (which this study is restricted to), 262 (44.3%) were male, whilst 330 (55.7%) were female. Ages ranged from 29 to 66 years (mean = 47.6, SD = ± 6.9). The population is represented in Figure 1.



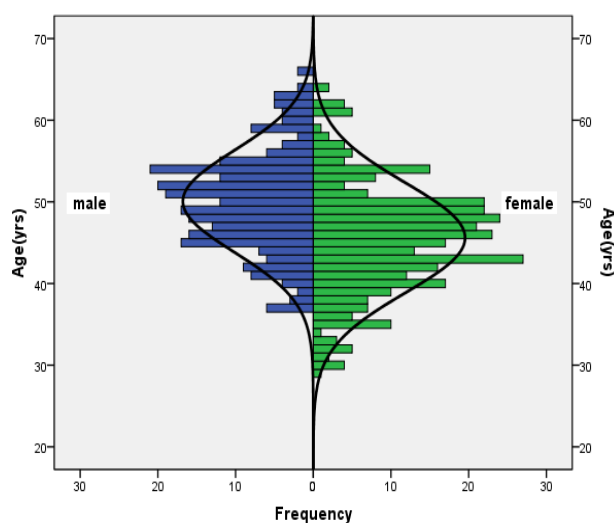


Figure 1: Population pyramid of the 592 soccer participants via age and gender (line of normality included).

This sub-sample of soccer players represented: Australia (362 participants/namely 61.1% of the total), Canada (141/23.8%), United States of

America (50/8.4%), New Zealand (22/3.7%), Brazil (4/0.7%), other countries (5/0.8%) or the country was not specified (8/1.4%) (see Figure 2).

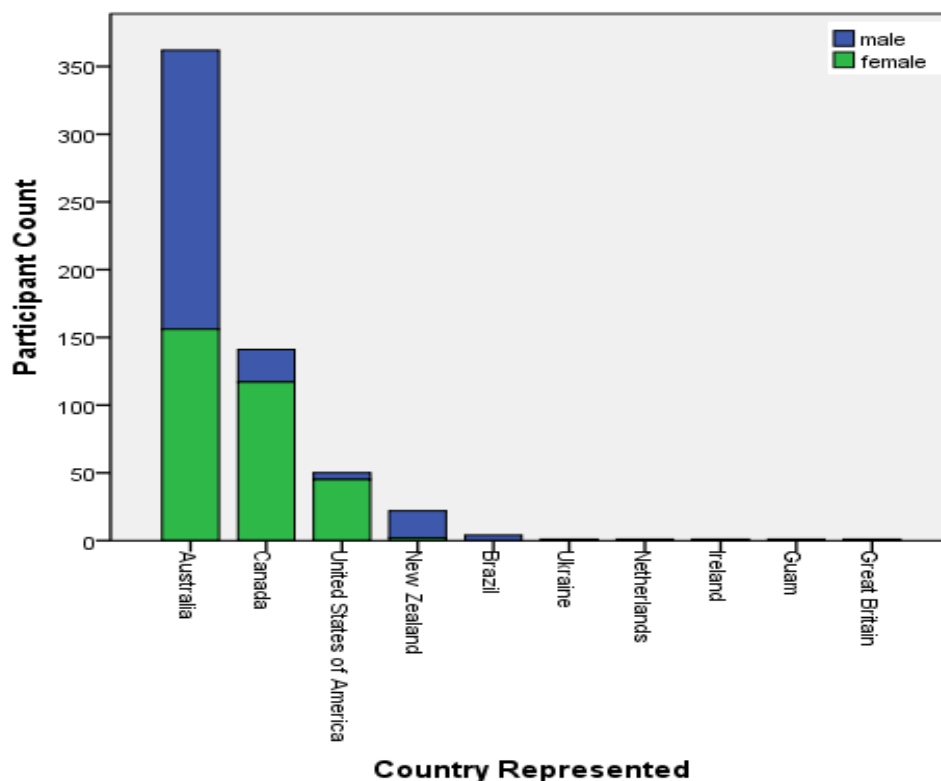


Figure 2: Survey participation by country showing negligible participation for other than the four main countries

Only 25 (9.5%) males and 29 (8.8%) females had a BMI $\geq 30 \text{ kg/m}^2$, indicating that obesity based on BMI was a health risk factor for 9.1% of the sub-sample. It was considered appropriate to compare the value for obesity with figures for the general population for those available for participant countries of the sample.

For Australians aged between 30- and 65-years-old ($n=9,501$), 24.8% were classified as obese, using self-reported heights and weights. For males, 25.6% and 24.0% of females were found to have a BMI $\geq 30 \text{ kg/m}^2$, a significant difference ($\chi^2=4.90$, $p<0.05$) in this ABS data. Without differentiating by gender, the difference between ABS and WMG soccer athletes was found to be significant ($\chi^2=78.0$, $p<0.001$). Comparing gender sub-sets identified, this

pattern also applied with significant difference for males ($\chi^2=35.5$, $p<0.001$) and females ($\chi^2=41.9$, $p<0.001$). Comparison to measured (as opposed to self-reported) data from the ABS survey also confirmed these findings using all subjects within the age range, as well as when considering gender sub-sets in isolation (all p -values <0.001). Comparison to sample populations¹⁷⁻¹⁹ from the other most represented countries, Canada, U.S.A. and New Zealand, as well as the UK²⁰⁻²², also identified significantly less (all p -values <0.001) obesity in the WMG soccer players than the national populations. While BMI on a population scale tends to increase with age, it was shown that the overall prevalence of obesity of the soccer population (9.1%) was still significantly lower, irrespective of age, than for comparative age groups in the Australian population (Table 1).

Table 1: Breakdown of obesity by age for ABS and WMG data

ABS Age Bracket (Years)	Percentage Obese (%)	WMG Soccer Age Bracket (Years)	Percentage Obese (%)
30-34	19.6	30-40	7.7*
35-39	21.3		
40-44	27.4	40-50	10.5*
45-49	24.1		
50-54	25.7	50-60	8.5*
55-59	28.0		
60-64	25.5	60-66	3.0*
65-69	28.4		

*WMG soccer player BMI significantly less than corresponding ABS age group ($p<0.001$) using Pearson chi-square

For the WMG soccer players, 1 male (0.2% of males) and 6 females (1.8% of females), namely 1.2% of the athletes were underweight (BMI $< 18.5 \text{ kg/m}^2$), comparing favourably to the ABS data for which 1.4% of participants aged 30-65 years were underweight. However, this difference was not statistically significant ($\chi^2=0.20$, $p>0.05$). Examination of the difference between ABS (0.7% of males and 2.1% of females

underweight) and WMG samples also did not show significant differences, when considering either males ($\chi^2=0.38$, $p>0.05$) or females ($\chi^2=0.13$, $p>0.05$). While there was an apparent gender trend within the masters athlete sample, due to the combination of a large sample of soccer players and small numbers of underweight participants and therefore low chi-square contingency table cell counts, it was deemed inappropriate to



analyze for any statistical significance in this difference while considering the data in categorical form.

The mean BMI for the soccer players was 25.1kg/m^2 ($\text{SD} \pm 3.6$), a value classified as overweight. Due to evidence of non-normality and heteroscedasticity ($F=4.19$, $p<0.05$), a Mann-Whitney U test was used to compare genders. As hypothesised, the mean BMI of male soccer players was higher than the mean of female soccer players (26.0 kg/m^2 vs. 24.4 kg/m^2 , $Z=7.15$, $p<0.001$).

Discussion

Due to large participant numbers ($n=592$), from only one sport of 28 played, this sub-sample of athletes can be considered as representative of soccer players at the Sydney WMG. Results identified significantly less obesity than for a comparative population of age-matched Australians. As a similar trend was present in the other national populations used for comparative purposes, this would indicate that the trend could be fairly assumed to apply, to some extent, on a broader-scale.

The majority of athletes were from the Australian population, but comparison to the other national populations was made in order to eliminate the possibility of an erroneous result due to mixed nationalities. It was clear that the trend in significance persisted across seven comparative national populations. It was therefore appropriate to consider that BMI of participants was lower than the general population from the constituent countries, so there was not causation by nationality for Australia. As the other national populations were surveyed in a variety of ways (self-administered questionnaires, investigator administered questionnaires, physical measurements or combinations of these methods) care was to be taken when comparison was made to the self-reported data on the Sydney WMG

soccer players. The ABS data using self-reported heights and weights was appropriate to use; however, the trend in difference persisted regardless of sampling procedures used in data collection. Although self-reported data may underestimate BMI, the ABS data was deemed comparable as it was also self-reported. Also, given the size of the BMI difference between the ABS and soccer groups in relation to the ABS measured and self-reported BMI difference, any error in self-reported survey results could be considered as comparatively negligible.

It is plausible that due to athletic activity, a reduced fat: lean body mass ratio was more likely in soccer players than the national population. This may theoretically have resulted in a higher BMI, which may be primarily an effect of increased lean muscle mass, as opposed to a high body fat percentage. However, it is also possible that the benefits from high relative strength in soccer (the ability to accelerate an object is inversely proportional to its mass for any given applied force and directly proportional to the force), would result in a greater ability to move on the field and therefore a lower BMI would be advantageous. It should be noted that the issue of causation must also be considered. Namely, the question of whether competing in masters soccer promotes reduced BMI and lowers associated health risks or alternatively whether individuals with lower BMIs participate in masters soccer by preference. A certain somatotype may attract athletes to the sport, or athletes may compete simply because they are capable due to improved health (due to its relationship with BMI) with age.

Prediction of body composition classification from BMI is reliable with a general population; however, in athletes this relationship between BMI and health may be



biased by high lean mass (muscle). Therefore, especially in male athletes, due to increased muscularity, the relationship between BMI and health should be investigated in more detail. This is particularly relevant given the deleterious influence of a high BMI on the health of males has been found to be greater than for females.

Conclusion

This study found that one key index of health, namely obesity, was on average far lower in male and female masters soccer players compared to a representative sample of age-matched controls. This finding may indicate a lower risk for many diseases, such as type 2 diabetes or heart disease, in masters soccer players compared to the general population. It was also found that BMI was significantly higher for male Sydney WMG soccer players than for females.

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